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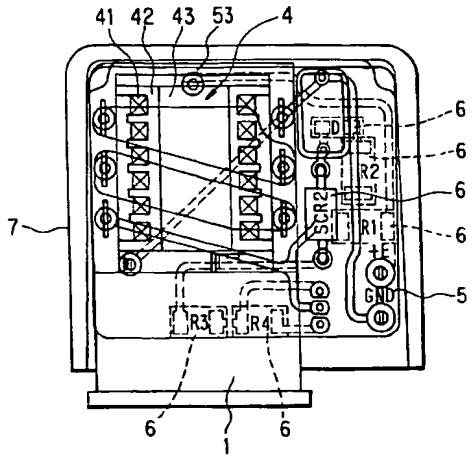
(54) Discharge lamp lighting device

(57) A discharge-lamp lighting device has a housing (7) with a power supply socket (8) formed therein and accommodating a printed circuit board (5) with a coil case (2) having a primary coil formed by plural parallel plate-conductors insert-molded around the body thereof and a discharge lamp socket (1) integrally fitted thereon and including a secondary coil (4) therein. A lamp lighting circuit is formed by mounting the coil case (2) on the printed circuit board (5). The discharge lamp lighting device is formed as a single solid device by potting all the components in the housing (7) with insulating resin poured in a melted state and solidified therein, thus eliminating the need of laying a high-voltage cable between the circuitry and the lamp socket.

FIG. 1



EP 0 902 605 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a discharge-lamp lighting device used as headlights of a vehicle and so on.

[0002] With conventional discharge lamps (Fig. 12) used as headlights of a vehicle, lamp sockets 1 are provided in respective lamp-mounting places of the vehicle and lamp-lighting devices 15 each containing a high-voltage generating transformer with a control circuit assembled on a printed circuit board are separately mounted in a bonnet of the vehicle, then the lamp-lighting lighting devices 15 are connected to the respective lamp sockets by using separate high-voltage cables 16 and low-voltage cables 17.

[0003] Japanese Laid-open Patent Publication No. 8-130127 discloses a compact discharge-lamp lighting device constructed as follows:

[0004] A coil case has a primary coil formed by plural plate conductors (insertions) molded thereon and contains therein a secondary-coil wound bobbin with a core inserted in a hollow center thereof and potted therein with insulating resin to form a solid coil case unit. The coil case unit is then mounted on a printed circuit board having a circuit component pattern to finish a discharge lamp lighting circuit. The printed circuit board is further provided with a shield portion for protecting the circuit elements against the possible affection of the high-voltage generating portion in the coil case unit.

[0005] As described above, the conventional discharge lamp lighting device requires separate arrangement of a lamp socket apart from the lamp lighting circuit unit and interconnection of them by using a high-voltage cable. This complicates the mounting work of the lighting device.

[0006] Furthermore, the use of elongated high-voltage cable may be associated with the risk of a leak current therefrom and reduction of the output voltage of the discharge lamp lighting device.

SUMMARY OF THE INVENTION

[0007] Accordingly, an object of the present invention is to provide a discharge-lamp lighting device that is compact and easy to mount with no need for laying a high-voltage cable by forming a single solid unit in which a lamp lighting circuit with a high-voltage portion mounted thereon is connected to a discharge lamp socket. The discharge lamp lighting device is constructed as follows: A coil case having a primary coil formed by plural plate-conductor insertions molded in parallel to each other around the coil case and containing a secondary-coil-wound bobbin with a core inserted in a hollow center thereof is mounted on a printed circuit board to form a discharge-lamp lighting circuit pattern together with circuit elements assembled thereon and a primary coil circuit pattern by connecting the plural plate-conductors in series therewith, thus forming an inner assembly of the device. The inner assembly is then placed in a housing having a power supply socket formed therein so that the top portion of the lamp socket is projecting from the housing and an input terminal of the primary coil is connected to a primary terminal. The inner assembly is finally potted in the housing with insulating resin poured in a melted state and solidified therein to form a single solid device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 is a plan view of a discharge lamp lighting device according to an aspect of the present invention.

Fig. 2 is a sectional side view of the discharge lamp lighting device of Fig. 1.

Fig. 3 is a front end view of the discharge lamp lighting device of Fig. 1.

Fig. 4 is a rear end view, partly in section, of the discharge lamp lighting device of Fig. 1.

Fig. 5 is a longitudinal sectional view of the discharge lamp lighting device of Fig. 1.

Fig. 6 is a plan view of a coil case of the discharge lamp lighting device of Fig. 1.

Fig. 7 is a bottom view of the coil case of Fig. 6.

Fig. 8 is a front end view of the coil case of Fig. 6.

Fig. 9 is a block diagram of a lightning circuit of the discharge lamp lighting device of Fig. 1.

Fig. 10 is a top view of a printed circuit board of the discharge lamp lighting device of Fig. 1.

Fig. 11 is a bottom view of the printed circuit board of Fig. 10.

Fig. 12 is a view showing a conventional discharge-lamp lighting device and a discharge lamp socket.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] The preferred embodiments of the present invention will now be described in detail by way of example and with reference to the accompanying drawings.

[0010] In Figs. 1 to 5, a discharge lamp lighting device according to the present invention comprises a housing 7 having a power supply socket portion 8 integrally formed thereon and an inner assembly consisting a coil case 2 having a three plate-conductors formed around the coil-case body by insert molding method and a discharge-lamp socket 1 coaxially fitted thereto, a secondary coil unit 4 mounted in the coil case and connected at its output terminal to a terminal of the discharge-lamp socket 1 and a printed circuit board 5 having a discharge lamp lighting circuit pattern with elements 6 and a primary coil circuit pattern whereon the coil case mounted and connected at the three plate-conductors in

series with the primary coil pattern. The inner assembly is mounted in the housing 7 in such a manner that the discharge lamp socket 1 has a tip protruding the housing 7 and an input terminal of the primary coil is electrically connected to a terminal of the power supply socket 8 of the housing 7. The inner assembly is then potted in the housing 7 with insulating resin poured in a melted state and solidified therein to form a single solid device.

[0011] Figs. 6 to 8 illustrate a coil case having a discharge-lamp socket 1 coaxially disposed and integrally fitted thereon.

[0012] The coil case 2 is provided at its bottom with an opening 20 for fitting-in the secondary coil unit 4 and with projecting terminal pins 31 of respective conductor plates 3 formed around the coil case body.

[0013] The coil case 2 is mounted at a given position on the printed board 5 and connected thereto by inserting the terminal pins of the respective conducting plates into corresponding holes 31 formed in the printed board and bonding them therein. The conducting plates 3 are connected in series with the printed pattern provided on the printed circuit board to create a primary coil circuit thereon (Fig. 10).

[0014] The discharge lamp socket 1 has a high-voltage terminal 9 at a center thereof and a low-voltage terminal 10 around the center thereof.

[0015] The secondary coil unit 4 is composed of a coil bobbin 11 with a secondary coil 10 wound thereon and a core 43 inserted in a hollow center thereof.

[0016] The coil bobbin 42 is provided at one flanged end 421 with an input electrode 11 to which the starting end of the secondary coil 10 is secured. With the coil case 2 mounted at a specified position on the printed board 5, a terminal pin 111 of the input electrode 11 is inserted into a hole 53 made in the printed board 5 and bonded therein to connect the coil case with a line of an input voltage +E as shown in Fig. 4.

[0017] The coil bobbin is also provided at the other flanged end 422 with an output electrode to which the terminating end of the secondary coil is secured. With the coil case 2 mounted at a specified position on the printed board 5, the output electrode 12 is in contact with a rear end 91 of the high-voltage terminal 9 sticking from the discharge lamp socket 1 into the coil case 2 as shown in Fig. 5.

[0018] The secondary coil unit 4 is then potted in the coil case 2 with insulating resin poured in a melted state and solidified therein to form a single coil case unit.

[0019] Fig. 9 is illustrative of a lamp-lighting circuit for lighting a discharge lamp LP, which has a control circuit CNT that receives a driving voltage +E (DC 400V) when a lamp switch (not shown) is turned on and the controlled voltage is applied to the primary side of the high-voltage generating transformer T that in turn produces at its secondary side a high voltage (about 25 KV) for lighting the discharge lamp. After lighting the discharge lamp by applying the high voltage for an initial firing period, the control circuit CNT operates to directly supply the discharge lamp with a working voltage (100V) through the secondary side coil of the high-voltage generating transformer T to maintain the lamp in a lightning mode. Figs. 10 and 11 show a printed circuit board 5 implemented with a discharge lamp lighting circuit. Fig. 10 is illustrative of the top surface of the printed board 5, whereon a coil case 2 containing a secondary coil unit 4 is mounted and circuit elements 6 such as thyristors SCR1 and SCR2 and a capacitor C for a control circuit CNT are also mounted.

[0020] Fig. 11 is illustrative of the bottom surface of the printed circuit board 5, whereon circuit elements 6 such as resistors R1, R2, R3, R4 and diodes for the control circuit CN are mounted. All the circuit elements are interconnected by wiring patterns printed on the printed board to form the discharge-lamp lighting circuit shown in Fig. 9.

[0021] The printed circuit board 5 has a pair of holes 54 and 55 made therein for connection of a grounding terminal GND and a driving voltage terminal +E respectivrly. With the printed circuit board 5 mounted in the housing 7, rear-end pins of the terminals 13 and 14 of the power supply socket 8 of the housing are fitted in the corresponding holes 54 and 55 of the printed circuit board 5 to complete the electrical connection between the printed board 5 and the housing 7 as shown in Fig. 1.

[0022] In the discharge-lamp lighting device according to the present invention, the conducting plates 3 formed around the coil case 2 can also serve as an electromagnetic shield for effectively protecting all the surrounding electric components from the possible unwanted effect of the high-voltage produced for initial firing of the discharge lamp LP.

[0023] In the discharge lamp lighting device, the coil case 2 with the discharge lamp socket 1 integrally fitted thereon allows the secondary coil unit 4 to directly connect its output terminal of the secondary coil with the high-voltage terminal 9 of the discharge lamp socket 1 therein by merely fitting the secondary coil unit 4 in the coil case 2. This eliminates the need of wiring of a high-voltage circuit on the printed board 5 and the need of laying a high-voltage cable between the discharge lamp socket and the output end of the secondary coil. The optimal high-voltage connection is thus realized.

[0024] The discharge lamp lighting device is compact and can be directly mounted in a limited space of a headlight mounting portion of the vehicle. This lighting device is easy to assemble since it requires only connection of a power source to the power-supply socket 8 formed thereon, eliminating the need of using an elongated high-voltage cable.

[0025] As is apparent from the foregoing, the discharge lamp lighting device according to the present invention is advantageous in its compact single-unit design which is realized by mounting a secondary coil in a coil case with a discharge lamp socket integrally fitted thereto and plural conducting plates insert-molded

around the body thereof to form a primary coil serving also as shield plates, attaching the coil case onto a printed circuit board implemented with circuit elements to form a discharge-lamp lighting circuit thereon, mounting the printed circuit board with the coil case and circuit elements into a compact housing provided with a power supply socket fitted therein and potting the printed circuit board with the coil case in the housing with insulating resin poured in melted state and solidified. The electrical connection between component units of the device can be realized by merely assembling one unit with another. No additional wiring is required. The effective shield of the high-voltage portion is also achieved by the conducting plates forming the primary coil.

[0026] Particularly, the use of the discharge coil case having the discharge lamp socket integrally fitted thereto and suitably connected to the high-voltage portion of the coil case makes a compact discharge-lamp lighting device compact and easy to mount.

[0027] A discharge-lamp lighting device has a housing with a power supply socket formed therein and accommodating a printed circuit board with a coil case having a primary coil formed by plural parallel plate-conductors insert-molded around the body thereof and a discharge lamp socket integrally fitted thereon and including a secondary coil therein. A lamp lighting circuit is formed by mounting the coil case on the printed circuit board. The discharge lamp lighting device is formed as a single solid device by potting all the components in the housing with insulating resin poured in a melted state and solidified therein, thus eliminating the need of laying a high-voltage cable between the circuitry and the lamp socket.

Claims

1. A discharge lamp lighting device having a housing with a power supply socket integrally formed therein and accommodating therein a discharge-lamp lighting-circuit assembly comprising a printed circuit board with wiring patterns and circuit components comprising a lamp lighting circuit thereon and a coil case mounted on the printed circuit and connected thereto, said coil case having a primary coil formed by plural plate-conductors formed in parallel to each other at an outer surface thereof and a discharge lamp socket integrally formed thereon and including therein a secondary-coil wounded bobbin with a core inserted in a hollow center thereof, wherein the discharge-lamp lighting-circuit assembly is mounted in the housing with a top portion of the discharge lamp socket projecting from an open-end of the housing and is connected at an output terminal of the coil case to the power supply socket formed in the housing and potted in the housing with insulating resin poured in a melted state and solidified therein to form a single solid device.

FIG. 1

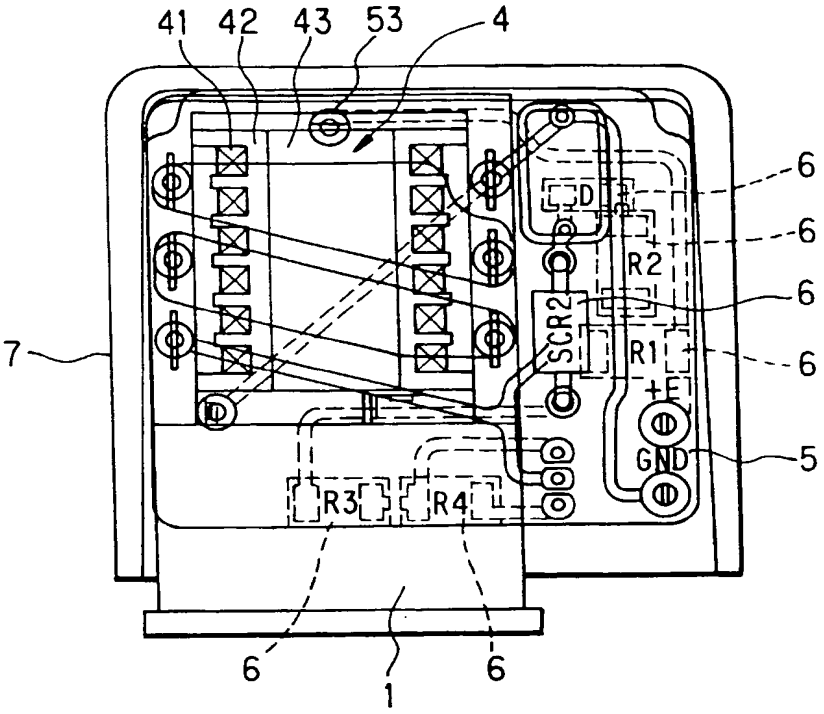


FIG. 2

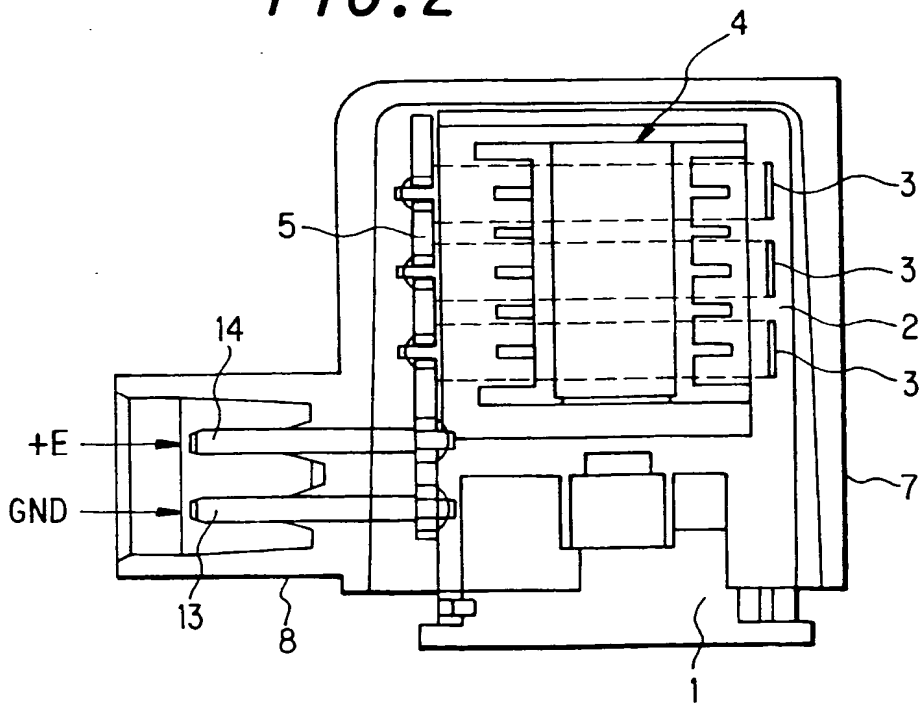


FIG. 3

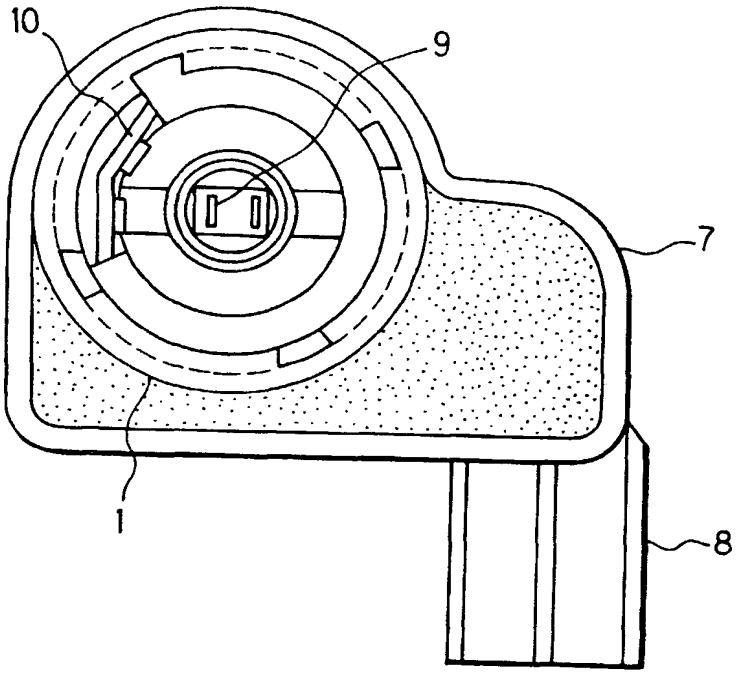


FIG. 4

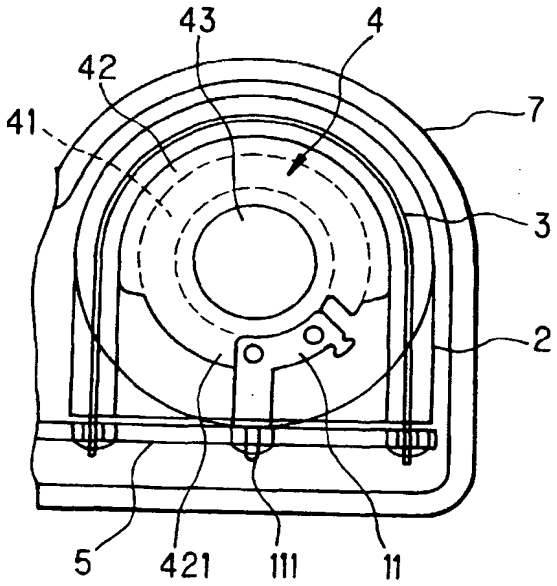


FIG.5

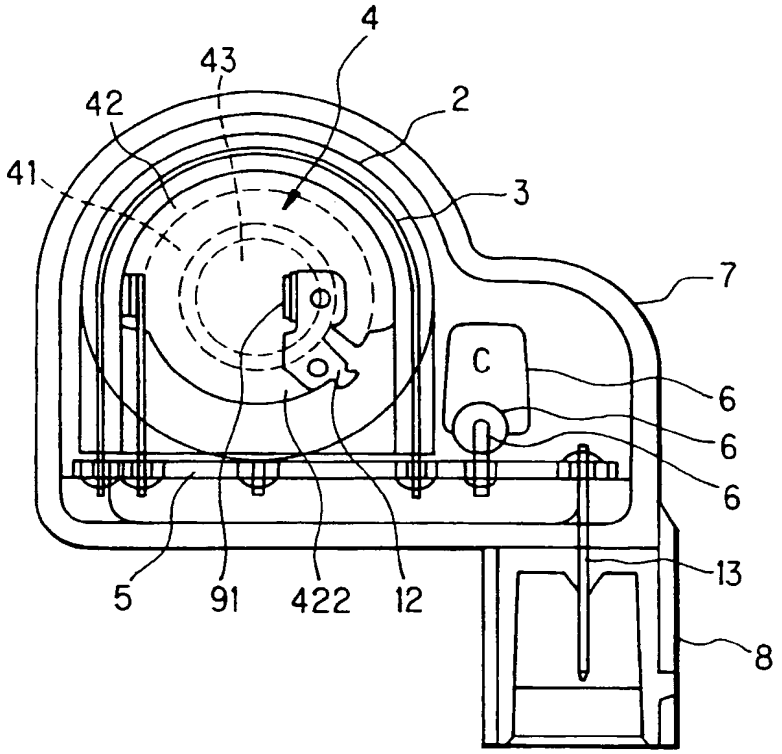


FIG.6

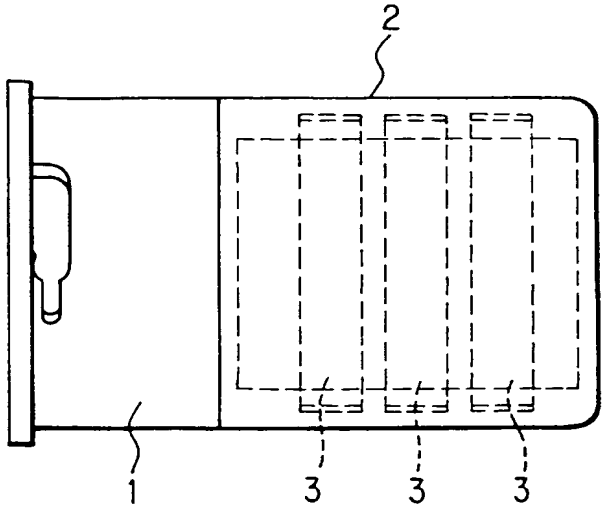


FIG. 7

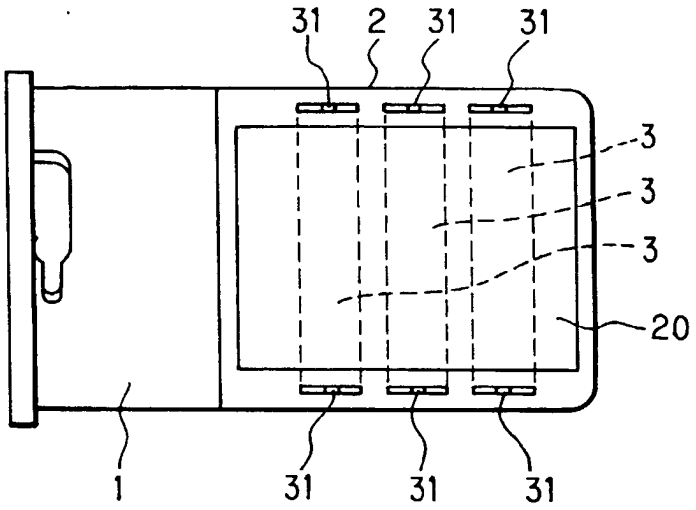


FIG. 8

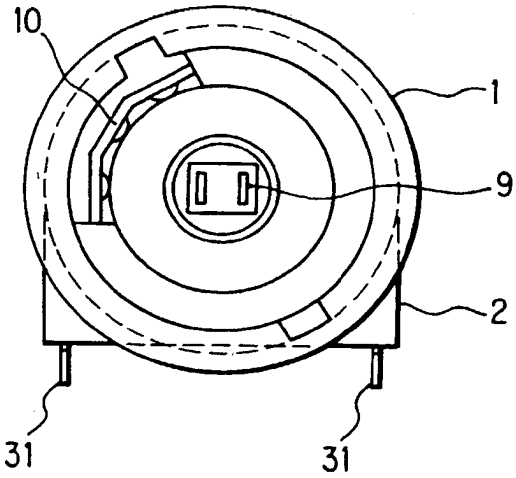


FIG. 9

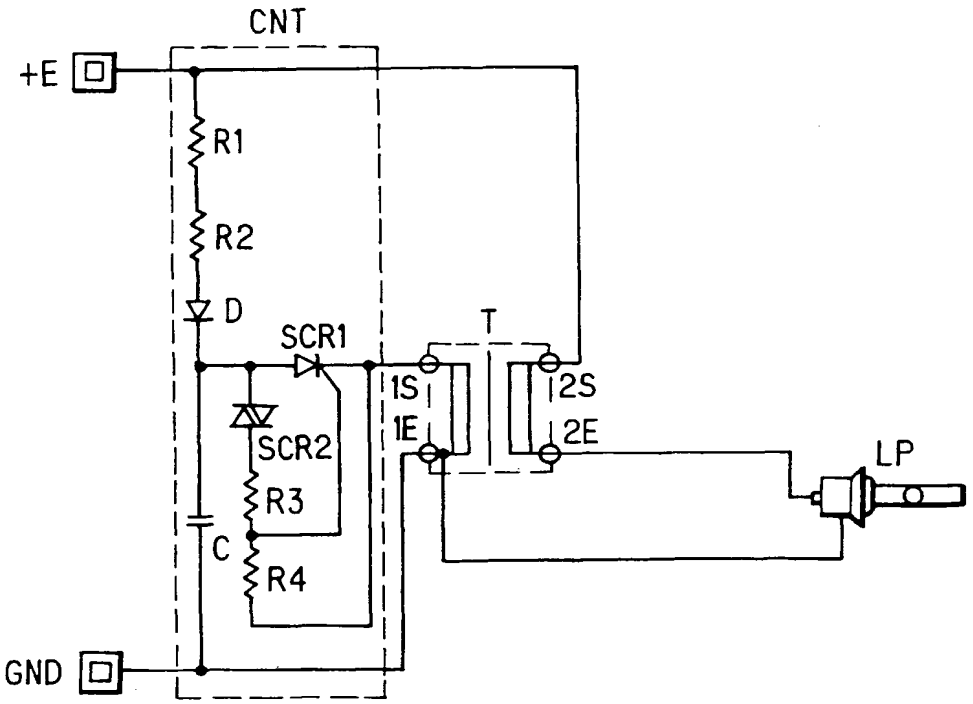


FIG. 10

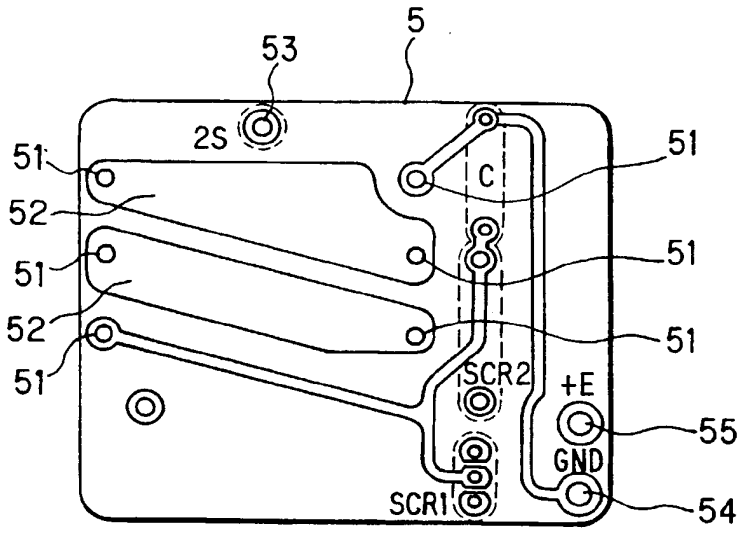


FIG. 11

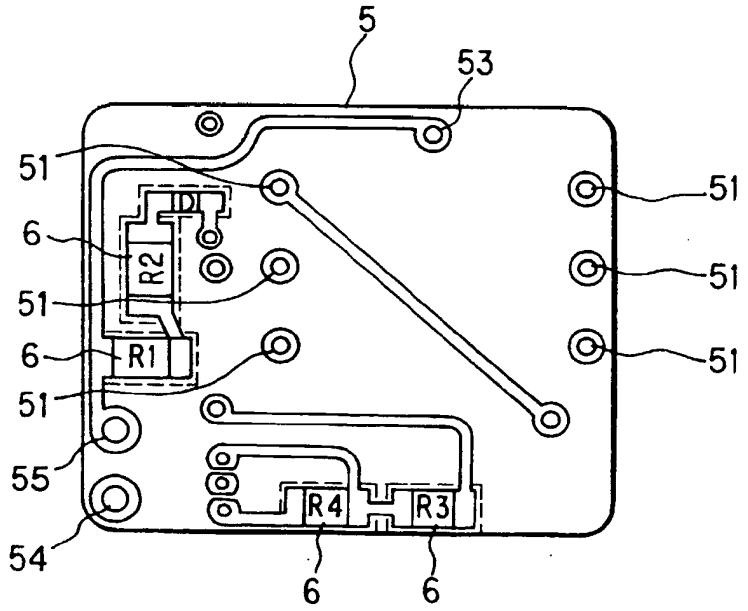
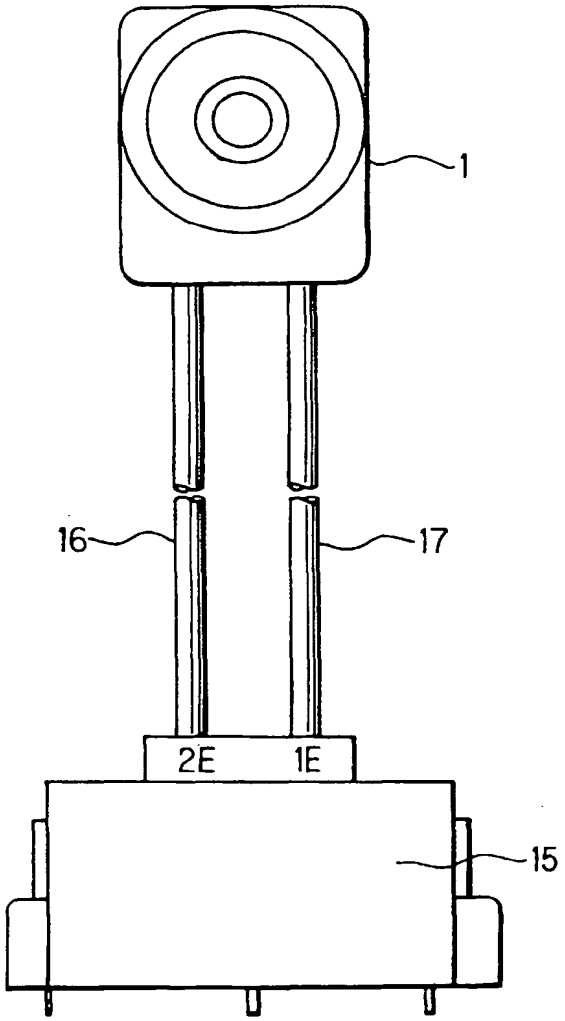


FIG. 12



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EUROPEAN SEARCH REPORT

Application Number EP 98116473.4

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 6)
A	US 5600208 A (KATOU et al.) 04 February 1997 (04.02.97), abstract, fig.. --	1	H 05 B 41/02
A, P	EP 0855851 A2 (TOYO DENSO KABUSHIKI KAISHA) 29 July 1998 (29.07.98), abstract, fig.. ----	1	

TECHNICAL FIELDS SEARCHED (Int. Cl. 6)

H 05 B 37/00
H 05 B 41/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	15-12-1998	FELLNER

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US A 5600208	04-02-97	DE A1 19541438 JP A2 8138872	15-05-96 31-05-96
EP A2 855851	29-07-98	JP A2 10214733	11-08-98

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